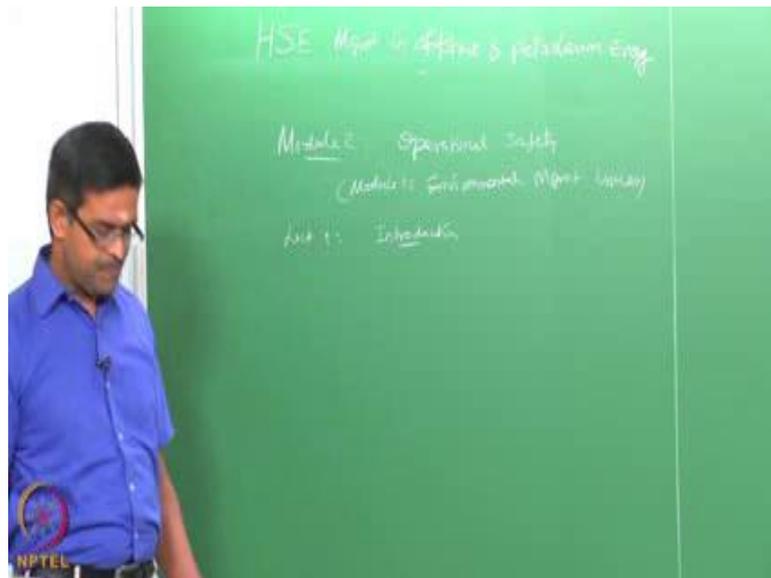


**Health, Safety and Environmental Management in Offshore and Petroleum
Engineering**
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Module – 02
Operational Safety
Lecture – 01
Introduction

Friends, welcome to the online course titled Health, Safety and Environmental Management in Offshore and Petroleum Engineering, which is abbreviated as HSE.

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We now talk about lectures on module 2; module 2 we focus on operational safety. We all know that module 1; we focused on environmental management issues. We had about 9 lectures on this, when we completed module 1. Now, I would request the viewers to understand the lectures of module 1 to better to follow the lectures on module 2 though they are slightly independent, but there is some overlapping of certain subject areas which you need to understand before you take up the module 2 lectures.

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So, in module 2 we will talk about lecture 1 to it is a lecture. Now, we will introduce certain basic terminologies which are related to operational safety in module 2. We will talk about this scope; we will cover certain terminologies related to HSE. We will talk about safety assurance, how do you ensure safety in the working environment? Then we will talk about how to organize safety? What are the rules and regimens which you can follow? Then we will talk about what are the good practices of safety in design and operations? We will focus these ideas related to oil and gas industries in specific and in general any process industry related to chemical process industries. Therefore, this can be of interest to chemical engineers and chemistry graduates where they can realize certain applications of their industries also be in this been discussed in this lectures.

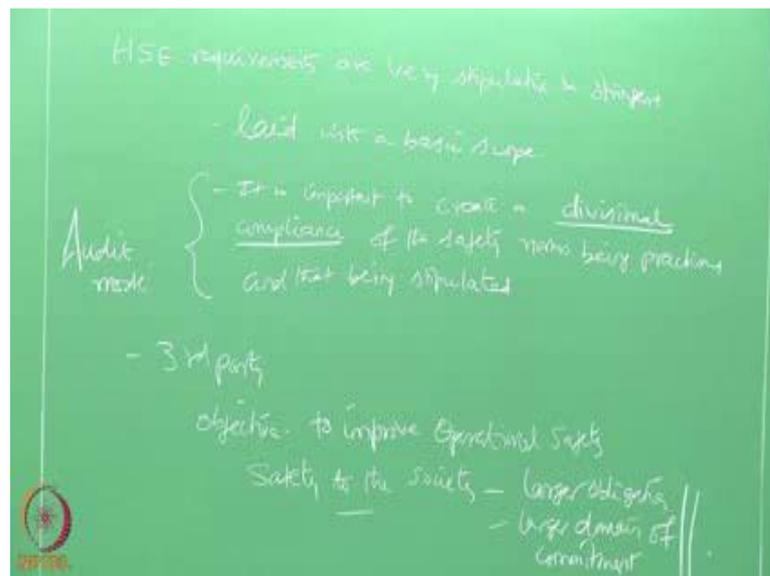
Once we understand this, we move on to hazard. We discussed about hazard interaction applicable to environment management in first module, but here we will talk about hazard assessment related to purely operational safety perspective. So, hazards we will talk about classification of hazard, how do you classify and how do you assess? We will also talk about hazard evaluation and how will you control? Then we will talk about hazard assessment study which is qualitatively done exclusively of process industries, which is famously called as hazard studies. We will dedicate few lectures on this; we will also do couple of case study examples which we did on the risk perspective in IIT,

Madras. So, we will talk about this in this particular thing.

Then we will also talk about very interesting area of application of risk assessment where vulnerability of mechanical components, which are in operational features can be ascertained using what we call failure mode and effect analysis which is FMEA, which is very interesting study. We will give you many case studies and examples on research perceptible industrial applications where we personally get in IIT, Madras where we talk about FMEA. So, this is going to the broad outline of the lectures. What we will talk about in module 2 or we will be reoriented to the focus of operational safety especially in process industry in general and in particular examples picked up from oil and gas industry. Having said this let us talk about introduction. Let us talk about certain terminologies which are very important in HSE.

So, let's us first understand why actually is HSE is a very important segment of understanding as an offshore and gas production engineer. So, health safety and environment management has got three components is one of the integral way or integral part of the way of business.

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The moment I say business I am talking about here, the oil sector it is considered equally

important and wider in managing HSE especially in the oil and gas sector. HSE requirements are very stringent, are very stipulative and rather I should say stringent. They are very strict you cannot violate these regulations. They are generally laid with a basic scope let us try to understand the original scope of laying rules and regulations for emphasizing safety.

The basic scope is it is important to create a divisional compliance of a safety norms being practiced and that being stipulated. So, essentially if you look at HSE requirements it is more or less in what we call as in audit. So, HSE actually is one of the systematic audits that is generally conducted in every process industry, but very important to know HSE audits are mandatory for oil and gas industries. You have got to do HSE audit at least once in a year depending upon the frequency of accidents and the asset value of the declaring, minimum once in a year. Sometimes you would also see these HSE audits are repeated once in a semester or once in about 6 months

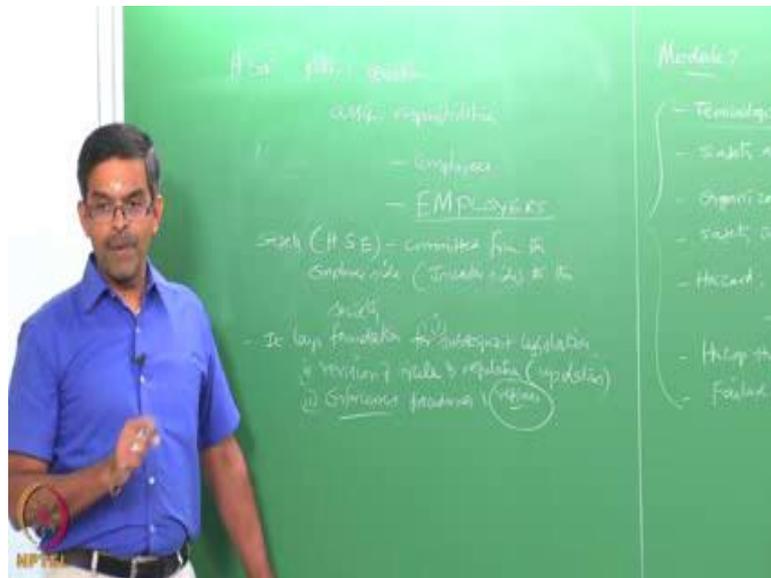
So, very important generally third party conducts the audit. Of course, the third party audits are then revisited to the internal HSE auditors of the company and overall objective is to only improve operations. The moment we say safety, it is not only related to safety of the people of the working personnel in the industry, it is safety to the society. So, it is not a very larger obligation and very larger domain of commitment. So, HSE it is not only specific to oil and gas industry it is derived from the oil gas industries to the societal benefits. So, there are standard policies which need to be laid and followed which are derived or framed keeping in mind the societal safety.

It is not the policy is derived keeping in mind the people who are working in the industries very, very important because very interesting question, why HSE policies should be framed by keeping societal benefit into account? As we have seen in the previous module lectures environmental pollution atmospheric pollution are important irreversible consequences that are likely to happen, if accidents or happening are allowed to happen in oil and gas sector at that process very seriously irreversible irreparable damage to the society in terms of assets in terms of human value in terms of economy, etcetera. Therefore, you cannot allow just because an industry is producing or exploring or processing oil, you cannot allow the sector to do whatever they want by compromising

the health and safety of the society.

Therefore, ladies and gentlemen, please understand HSE is always circumscribed keeping in mind the safety of the society and not only the safety of the people working in the industry. So, it is not pertaining only to the oil and gas industry it is pertaining the societal benefits which is derived which is controlled and laid on oil and gas industries. Therefore, HSE rules and regulations generally assign duties and responsibilities to the employers and the employees that is very, very important.

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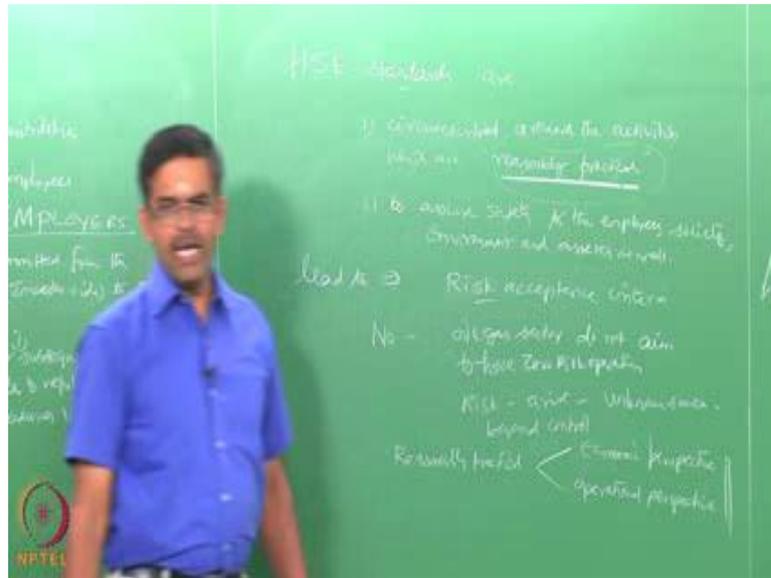
HSE rules and regulations assign responsibilities not only to the employees because their safety is very important, that is very important is they also cover certain commitment certain guarantee from the employers. So, employers or the investors or the apex personnel are also bound to ensure safety and they have to invest on safety as well. So, safety to be very specific health safety and environmental management on the whole on the complete circle is committed from the employers side, I should say from the investors side to the society you understand. Therefore, it is a very serious larger commitment therefore, I can say it lays foundation for subsequent legislation, for example, if the company did not bother, did not follow a safety norms which were violated and pointed out during the safety audits then there can be legislative measures

be taken against the company.

So, HSE lays foundation for subsequent legislations. Of course, revision of rules and regulations, the moment we say revision I am taking about updates I am not talking about compromises and thirdly subsequent legislations revision or rules and regulations and thirdly enforcement procedures and of course, the regimes also because we know the consequences that arise from the accidents or incidents caused in oil and gas industry can be local, can be regional, can be global. Therefore, exercising or enforcing HSE safety regulations cannot be always globalised it need to be also localized. So, regimes are also to be very carefully chosen a prior to the start of the business. So, the business inherently coupled with safety from day 1 of the planning of the business itself that is very interesting and very important and many of you may not be aware that HSE is a very, very vital chord right from the planning stage in oil and gas sector.

Now, the question comes when we said we are talking about laying a foundation of rules and regimes, etcetera. Then how HSE standards are actually lying, how are they framed? Who makes them? Who follows them? Who enforces them? Who checks them if it is violated? Who monitors them, etcetera? And how frequently they are done? Where is the team who is responsible for this? Is it a government audit? There are many millions questions comes in mind of safety professionals who would like to know this. So, let us talk about further in detail of this.

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So, I should say HSE standards which are laid by certain set of organizations. We will come to the argument side later are essentially circumscribed. They are circulated around the activities which are reasonably practical, be carefully understand this term. I am going to expand this slightly and give you a very sarcastic statement which is very, very applicable to HSE practices in oil and gas sector. So, circumscribed around the activities which are reasonably practical with the motive to assure safety to the employee's society environment and assets as well the moment we say safety rules are laid with keeping in mind reasonably practically. So, there are certain safety norms which can cost you very, very high of course, you can compromise on them if they are very vital. So, this argument will slightly lead to a very interesting statement which is applicable and prioritized only with oil and gas sector that what we call risk acceptance criteria.

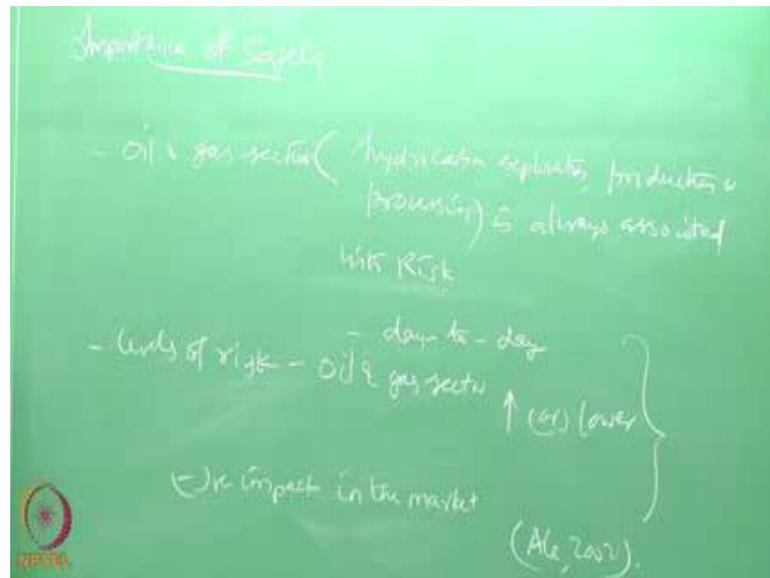
So, if you ask me a question, Sir, when safety norms are violated it is going to be very risky. So, do oil and gas industries claim that they are 0 risk operation, the answer is no. Oil and gas sector do not aim to have 0 risk operation, why because risk can arise from many unknown sources which are beyond control. So, if at all the risk arises you are what to see whether the prevention or correction of the risk situation or hazard scenario is reasonably practical in terms of economic perceptive operational perceptive. So, this needs to be answered.

Therefore, HSE regulations generally imposed general duties on the employees and the employers for facilitating the employees with the minimum health and safety norms and of course, minimum health and safety norms to the members of the public. The general duties of the employees refer to their own health and safety which are insisted as compulsory, for example, wearing shoes when you are in operational class, wearing a helmet when you are working on site, wearing goggles when you are doing a welding. So, you may not bother to wear a goggle, to wear a shoe or to wear a helmet, you may say, I may skip office, but the industry do not allow you do not give you a work permit, do not hire you if you do not follow the safety norms insisted by the company.

So, we say that HSE norms laid by the employer are more general in nature. They are not very specifically need not have to wear a white shirt, they are very specific in saying you have to do the following very strictly violation of that will cost your job or it may be a punitive method of correcting you. So, the general duties of safety norms are specified to the employees by the employers keeping in mind the basic safety and health norms of the employees and they are now insisted to the employees as regulatory measures, there is no option it is compulsion.

Now, the question comes if oil and gas sector is circumscribing with unresilient events which can cause very serious risk then importance of safety is very necessary, let us talk about importance of safety.

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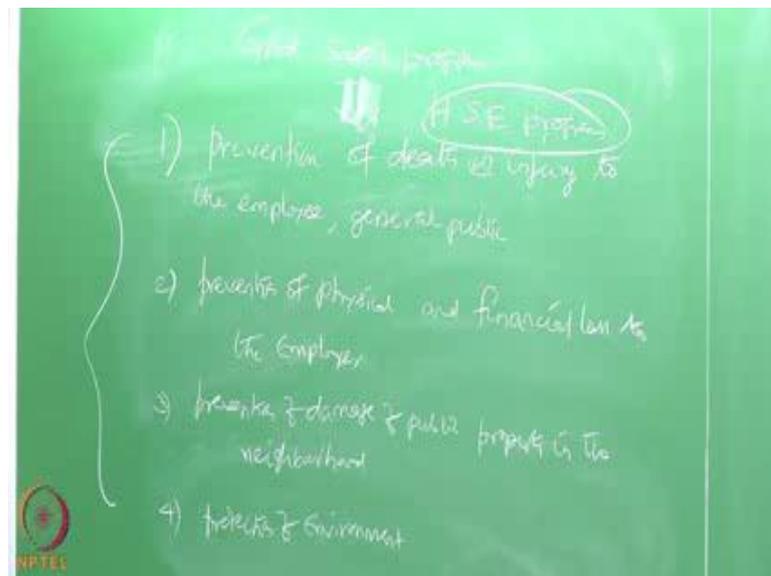


Just now, we said oil and gas sector to be very specific hydrocarbon exploration process production and processing is always associated with risk. I am not saying it is highly risky or low risky, but it is associated with risk which can happen in day to day life. One can ask me a question Sir, why risk is compulsory associated with only this industry? The answer is very interesting, risk is associated in everyday or walk of life in every one of us, why only with oil and gas sector that is why we insure our health, we insure our life, we insure our car and property, we insure assets, we foresee we anticipate unprecedented events which may likely to happen during the walk of my life therefore, insure my life.

So, safety is challenged in the form of risk which is unexpected which cannot be anticipated, which cannot be predicted, which cannot be modeled so easily and that degree is present in every activity you do every day. So, therefore, oil and gas sector is not an exemption, but it is very interesting to understand oil and gas sector has certain level of acceptance of risk, it cannot be 0 risk operator. There are certain levels of acceptance of risk which is different from everyday life. Therefore, levels of risks associated with oil and gas sector may be higher or lower compared to the other consequences involved.

These consequences affect the society very badly, affect the economy of the nation very badly and most importantly they create a negative impact about the company in the market. So, this factors which can lead to the negative association or impact or the image of the company which are purely derived only on safety violations norms is discussed very interestingly by Ale in 2002, for detail references please read this particular paper cited in the website of NPTEL. There is more information about very clear factors that can affect the stake holder's image then societal public. Now, it is important for us to understand and agree that prevention of death or injury to the worker is the first objective prevention of death or injury to the worker.

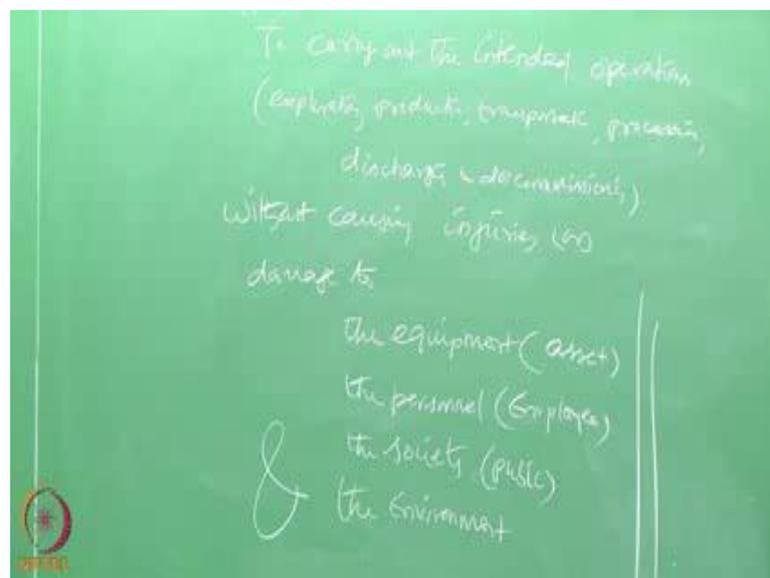
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I should say to the employee to the general public that is the first objective. The second objective could be prevention of physical and financial loss to the employer. Three prevention of damage of any public property in the neighborhood; Four protection of environment. So, all these could be objectives of a good safety program. Therefore, they are the primary objectives of any HSE. Hence, HSE rules and regulations for assuring safety are generally framed and strictly enforced in offshore and petroleum industries because this industries are seen as one of the important source of hazards which can cause and challenge pose threat to the environment in terms of ocean as well as an atmospheric pollution.

Therefore, the prime goal in the whole exercise is to protect the public property and environment along with a space where they are working and living. Therefore, it is a commitment from every employer of the oil and gas industry. In fact, every stake holder of this company towards the interest of the customer employer and all in the public therefore, the major objective of HSE rules and regulations is to carry out very intended operations in impact exploration production transportation processing discharging.

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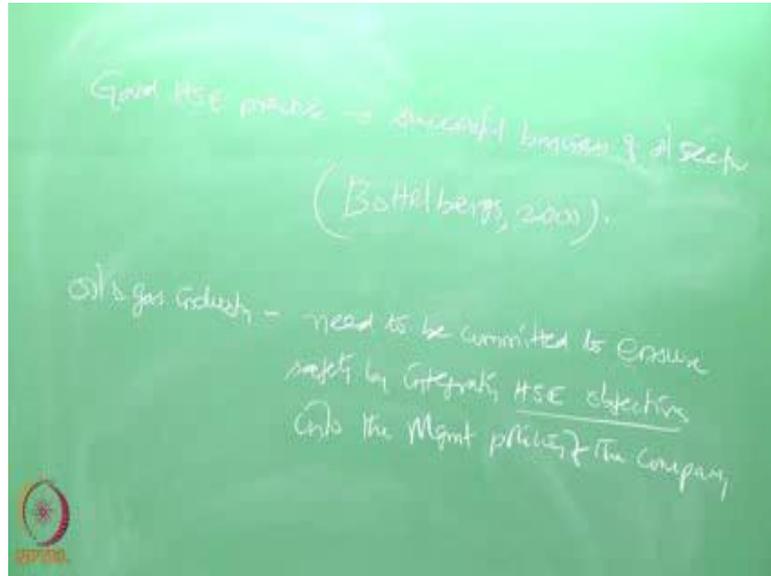


And decommissioning, I am giving you this in hierarchy can easily seen all these operations without causing injuries or damage to the equipment that is the asset to the personnel that is the employee to the public and the environment very interesting.

So, the objective is very broad for any HSE program keeping this in mind industries need to frame rules, which will include all possible applicable laws and relevant industry standards which can be practiced very easily. So, industries need to therefore, continuously evaluate the health safety environmental aspects of both equipments and services which are involved in the whole process. It is therefore, important for oil and gas industries to believe that defective HSE management will ensure a very good business from them, if we understand this particular statement as an employer then continuous improvement in HSE management practices will yield a very good return in

the business apart from ensuring goodness to the employee, which has been frequently clearly discussed from research study conducted by Bottel Bergs, 2000.

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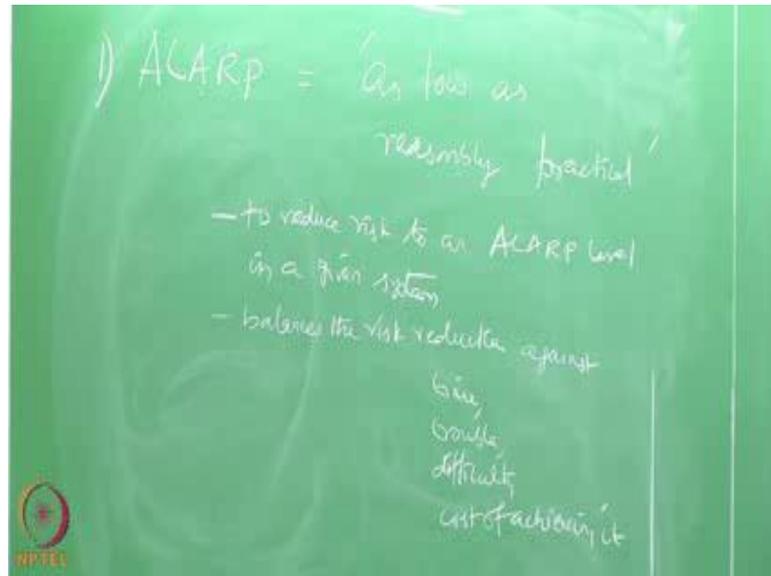


So, good HSE practice lead to successful business of the oil sector, Bottel Bergs, 2000 therefore, HSE practice which has become epicentric issue of the employer has to originate from the highest possible order of the employer. So, from the top management HSE rules are laid and also getting practiced through the entry level every employee should therefore, feel responsible and accountable for following HSE norms. What does it mean? Oil and gas industry which is one of the vital and potential resource of economic strength of any nation need to be committed to ensure safety by integrating the HSE objectives into the management policies of the company.

It is very interesting, HSE implications are not forced accidental views they are always looked into as preventive measures because HSE objectives should be integrated to the management policies of the company itself. So, therefore, it starts from the top hierarchy of the company it goes through successfully to the least and lowest level of the employee of the company. If every person in the whole chain practices HSE norms and realizes the importance of safety during his operational functionalities, then the success rate is very high because this reduces risk and adds value to the customer service which is expected

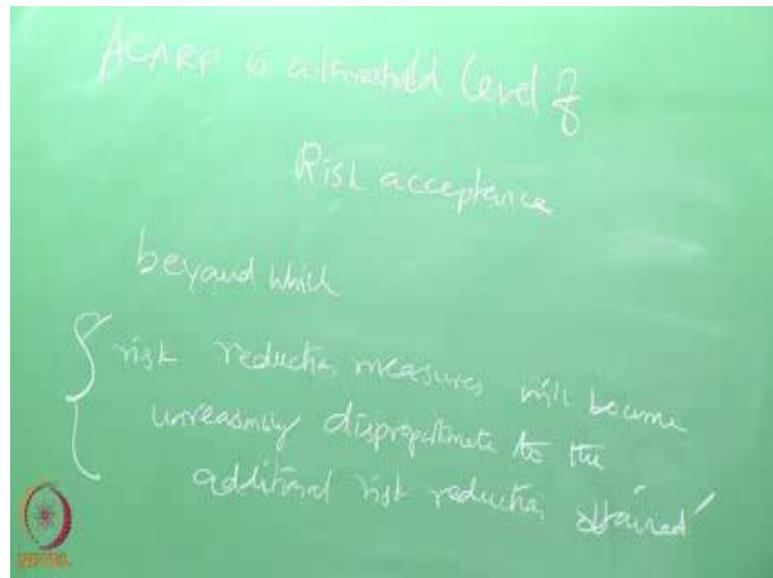
to the stakeholders of this industry. After understanding this introduction, let us now talk about basic terminologies in HSE.

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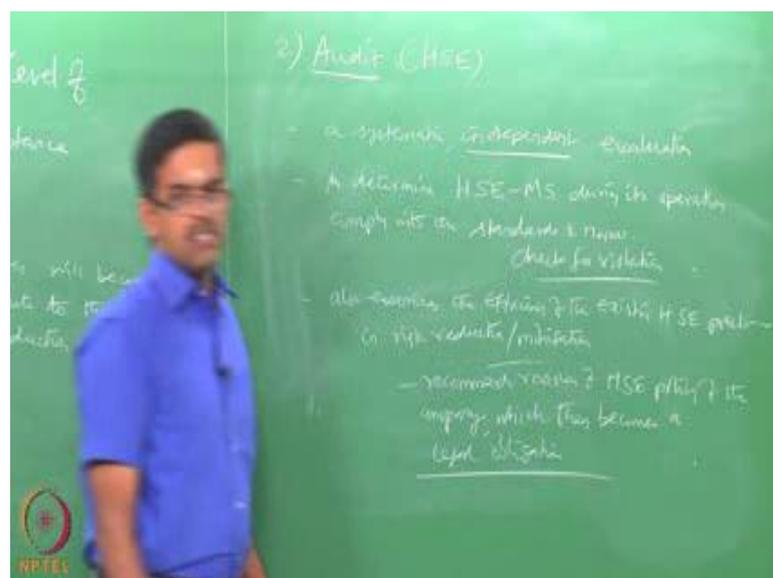
Let us list them ALARP, this expands for As Low as Reasonably Practical. The intention is to reduce risk to an ALARP level in a given system. It involves balancing; it balances the risk reduction against time trouble and pain difficulty and cost of achieving it. ALARP level is very important because this represents the point objectively assessed at which the time trouble and difficulty the cost of further reduction becomes unreasonably disproportionate to the additional risk reduction obtained. Therefore, ALARP is a threshold level of risk acceptance beyond which the reduction measures.

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The risk reduction measures will become unreasonably disproportionate to the additional risk reduction achieved. It is very important because of this understanding we also claim to have an acceptable risk level in oil and gas sector. The second term important audit which we say HSE audit or people may say safety audit.

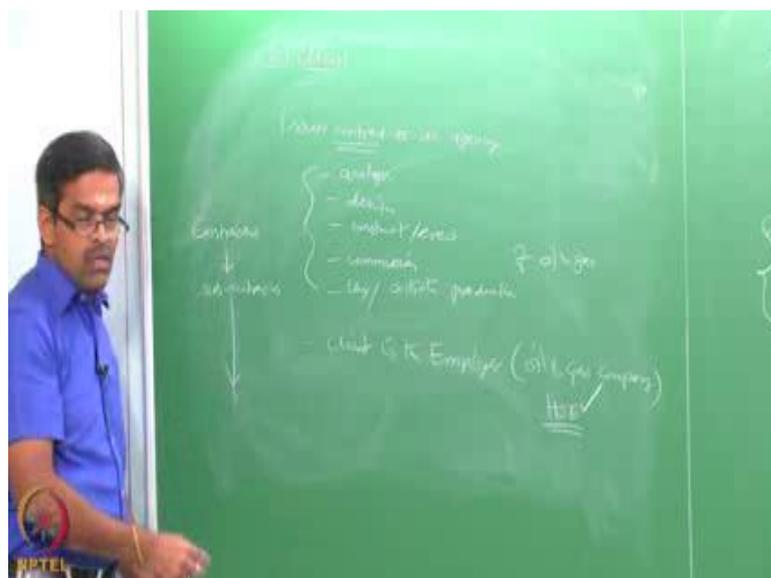
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It is a systematic independent evaluation, please understand all of us know that audit is a systematic method, but many of us may not know it is an independent evaluation, what is the objective of this? The objective of this to determine whether the HSE practiced in the management system and or during its operation comply with the standard and norms that is check for any violation, in addition to that audit also examines efficiency of the existing HSE practices in risk reduction or towards risk mitigation, and it recommends revision of HSE policy of the company which then becomes a legal obligation.

Please understand this is very important term I am using HSE audit recommendations, once made will compel the employer to modify the existing policies to ensure safety. So, it is not simply audited and left on the paper, it is taken to the existence level of practice it may cost more financial investment. If the risk reduction measures adopted with the company as found as observed by independent agency is not satisfactory. So, that is what I was saying oil and gas sector demands HSE audit at least once in a year as a part of the legislation. So, these recommendations made with the audit team may also land up in revising the company's policy towards safety and they are legally obliged to follow the revisions as recommended by the audit team. So, it is very serious issue. The third one is a very common term used in HSE practices claim.

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Now, interestingly the company or the employer issues contract to an agency, who can analyze, design, construct, erect, commission, lay and initiate production of oil and gas. The company does not do it by itself the issues contract the person who agrees to do this or the team or the company further, who agrees to do all these activities together or successfully are called contractors. These companies may also further hire subject matter experts on every segment to execute the work those people will be called as sub contractors.

The rules are client here in the whole document. The client generally is the company, usually it is the oil and gas companies itself that issues contract to the contractor or to the sub contractor to carry out the work. The contractor may then take care of the role of the client by issuing contracts or subcontracts. So, why I am saying this issue because company has a policy of HSE which is good in place company requests a contractor to execute the work, contractor's requests subcontractor who hires them to execute the work. Ultimately, the company does not execute the work directly, but very importantly please note whether the contractor or subcontractor whoever down the line the change need to follow the company's HSE policy strictly. If during the chain, if these people violate the company's policy, the audit team will not penalize these gentlemen the penalty will come to the company who is the client.

So, client owns the total responsibility of safety commitment to the society because he is the person who is hiring the contractor and subcontractors for getting the work done. So, the company cannot or the client cannot wash away his hands saying I am having a very good HSE policy, but my people who employed with me did not follow them and they should be penalized, no safety audit will always penalize will always look down the HSE policies of the company and it is the clients responsibility to check whether these policies are taken through the entire chain of work during operation. So, therefore, client term is very important in HSE bank. We look into further terms in the next lecture. We will continue with them.

So, we started with the second module lectures. Now, I hope you must have gone through all the lectures repeatedly in the first module to understand the consequences caused by the operations, oil and gas industries to the environment at the atmospheric

pollution. In this we are talking about the safety planning and importance of safety in the first lecture. Module 2 we started discussing about the introduction of HSE, why it is important? Who will be legally connected in HSE? How do you understand they are violated? How HSE policies are integrated to the safety assurance of the society and public? How claim sheet is very important in implementing successfully the HSE policies, etcetera? We will continue to discuss them in the coming lectures.

Thank you very much.